

## **Title: Equations in the Park!**

### **Brief Overview:**

In this unit students will have an exciting day in Safari Park as they explore algebraic concepts using real life situations. Students will have understanding of patterns and functions to complete function tables using a one-step operation (+, -,  $\times$ ,  $\div$  with no remainder) rule. Students will also find the unknown in an equation with one operation to create a board game.

### **NCTM Content Standard/National Science Education Standard:**

- Represent the idea of a variable as an unknown quantity using a letter or a symbol.
- Represent and analyze patterns and functions, using words, tables
- Express mathematical relationship using equations

### **Grade/Level:**

Grades 3-4

### **Duration/Length:**

Three Days (60 minutes each day)

### **Student Outcomes:**

Students will:

- Find the missing number (unknown) in a number sentence (equation) using operational symbols (addition, subtraction, multiplication, division).
- Create a function table.
- Find the missing number(s) (unknown) on one or both sides of a number sentence.
- Identify strategies to solve missing number problems in order to complete a brief constructed response.

### **Materials and Resources:**

Day 1

- Safari Operation Game worksheet (Pre-Assessment) (Student Resource1)
- Safari Park by Stuart J. Murphy ( MathStart Series)
- Tickets Graphic Organizer (can be placed on Visualizer/overhead) (Teacher Resource 1)
- Ticket Pattern (Teacher Resource 2)
- Safari Fun Assessment Worksheet (Student Resource 2)
- Safari Animal Patterns (Teacher Resource 3)
- Scissors

Day 2

- Plastic miniature animals or teddy bear counters
- Safari Park by Stuart J. Murphy ( Math Start Series)

- Balance Scale (Teacher Resource 4)
- Monkey Play worksheet (Student Resource 3, Teacher Resource 6)
- Assessment (Student Resource 4, Teacher Resource 7)
- In and Out Safari (Teacher Resource 5)
- Safari Animal Pattern (Teacher Resource 2)
- Scissors
- Calculators

### Day 3

- Safari Function worksheet (Student Resource 5)
- Safari Times (Student Resource 6, Teacher Resource 9)
- Safari Park Board game summative (Student Resource 7)
- Safari Park by Stuart J. Murphy ( Math Start Series)
- Guess my Rule directions (Teacher Resource 8)
- Ticket Pattern (Teacher Resource 3)
- Safari Animal Patterns (Teacher Resource 2)
- Safari Park Board Game Directions (Teacher Resource 10)
- Game Board (Teacher Resource 12 and 13)
- Scissors
- Spinner (Teacher Resource 11)
- Paper clips for Spinner
- Calculators

## Development/Procedures:

### Day 1

- Pre-assessment  
Distribute the Safari Operation game worksheet to each student (Student Resource 1). The objective of the game is to place the operation sign that will make the equation true.  
( $4 \times 6 = 24$ ,  $9 + 15 = 24$ ,  $28 - 4 = 24$ ,  $48 \div 2 = 24$ )
- Engagement  
Explain to the students that a new amusement park, Safari Park, has just opened and they will be taking a trip to the park. Have students predict what they will discover during their trip to the park. Explain that the supermarket gave away free tickets for Safari Park rides, games, and food and you were given 20 tickets. Write an equation that equals 20.
- Exploration  
Read aloud the book, *Safari Park*, and complete the graphic organizer listing the prices for tickets (Teacher Resource 1 - Jungle King 4 tickets, Rhino Rides 2 tickets, Monkey Game 1 ticket, Terrible Tarantula 6 tickets, Tiger Treats 1 ticket). The students will tell the rides they would like to go on. Review the term, *function*, and *variable* with the students. A variable is an unknown quantity using a letter or a symbol. Function is a constant qualitative relationship between a pair of numbers. Students will brainstorm examples of expressions from the book.  
  
Encourage students to investigate how a change in one variable relates to a change in a second variable. For example:

# of Students	1	2	3	5
# of total tickets	2	4	6	$n$

What would  $n$  equal ?  $n=10$

Chad has 14 tickets and receives 5 more ( $14+5$ ). Can you determine how many tickets Chad has altogether? Ask students: Is there a difference if the statement read: Chad has some tickets and got 5 more? Can you still determine how many tickets he has altogether? (*No*) Since we do not know the number of tickets Chad started with, we can use a letter to represent the unknown amount ( $t+5$ ). This letter for the unknown amount of tickets is called a variable. You can substitute different numbers for the variable to determine how many tickets Chad has altogether. Tell students they will each receive 2 tickets. Give two students 2 tickets each and ask how many tickets have been given out? Begin making a chart to determine the total number of tickets given to students.

Record the following on the board.

# of Students I n	2	5	3	
# of total tickets t e	4	10	6	

2, then 3 more students to take (2) tickets each and have them stand in front of the class to provide a visual for completing the table (Teacher Resource 2). Explain to the students that the total number of tickets depends upon how many students have been given tickets. Reminder: This relationship is a function that will help them determine the rule for the total number of tickets ( $2n$ ).

Introduce the algebraic format for showing multiplication (*number precedes variable. There is no operational symbol*). Reinforce the term variable as an unknown. The variable in this situation is used to represent the number of students.

○ Explanation

Have students evaluate the following expression for  $b=5$ ,  $b=8$ , and  $b=15$   
 $b+19$ ,  $b-2$ ,  $13+b$   $37-b$ ,  $123+b$

Copy this table on to the board. Complete the function table using the rule, add 19.

In	Out
5	24
8	27
15	34

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- Application  
Students will complete a function table in their math journals for the following situation: Alicia earns \$4.00 an hour at Safari Park. Make a function table to show much she will earn for 5, 8, and 12 hours?
- Differentiation
  - Reteach
    - Students can cut out “Safari Animal Pattern” as manipulatives to aid in the completion of the function table.
  - Enrich
    - Students can add additional slots to the function table using other numbers.
- Assessment  
Students will write and create their own problem and function table expressing their interest in the activities they would like to participate in the park (Student Resource 2 Safari Fun).

## Day 2

- Engagement  
  
Introduce the balance scale to the students. Discuss ways in which the balance can be used. Students will use miniature animal figures to balance the scale. The balance is used to show equity between each side of the scale.
- Exploration  
Students will use an “In and Out” table as a “balance scale”. Each Rhino would weigh the same amount as X amount of monkeys. Use the overhead or Visualizer to show the scale to the students (Teacher Resource 4). Copy the two following examples for students to record in their math journals (Answer Key:, Teacher Resource 5).  
The students will discuss the patterns they see on the balance scale. Have students determine how they would display this information on a table.

Complete the table:

# of Rhinos	1		12	9
# of monkeys	5	15		45

Complete the table: (1 Rhino equals 10 monkeys)

# of Rhinos	1	10	5	
# of monkeys		100	50	250

○ Explanation

Have students create an “In and Out” table for monkeys. When you put in X monkeys you will get Z monkeys in return (Distribute Student Resource 3, Teacher Resource 6).

Complete the function table

<u>In</u> Monkeys	<u>Out</u> Monkeys
12	36
	72
8	
100	

○ Application

Students can create their own “In and Out” table in their math journals for their classmates to solve.

- Differentiation
  - Reteach - Students who had difficulty with the “In and Out” table can use multiplication chart and calculators.
  - Enrich - Create an “In and Out” table in their math journals that uses more than one operation.
- Assessment
 

Students will create a table that contains different number of rides for various amounts of tickets. Teacher Resource 7, Student Resource 4

### Day 3

- Engagement
  - Students will review variables with the following problem.
  - Write the following on the board.
  - Each ride is worth  $t$  number of tickets. If 5 students rode the Hippo Drome, how many tickets would the attendant collect?
  - Write an equation that represents how many tickets were collected.
  - Students will record equation(s) into their math journals.
  - $5t$  which is  $5 \times 2 = 10$  tickets.
- Exploration
  - Review the book, Safari Park.
  - Students will discuss the patterns that they see and hear in the story.
  - Have students give the rule in the relationship between number of rides and tickets required.
  - Students will create their own “Guess My Rule” (Teacher Resource 8, Student Resource 2).

#### Guess My Rule!

	4	6	10	100
# of rides				
# of tickets	12	18	30	(300)

- Explanation
  - Distribute Student Resource 5- Safari Function.
  - Have students complete a function table for 100 tickets
  - Students can take as many rides as possible but the Total number of tickets must equal 100 tickets.
  - James used all 50 tickets. He wants to ride the Terrible Tarantula ride 5 times. What other activities could he do with his remaining tickets?
  - Complete the table.

Terrible Tarantula 6 tickets	Single King tickets	no Rides tickets	Key Game ticket	Liger Treats 1 ticket	Total # of Tickets
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$6 \times 5 = 30$					50
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50

- Application
  - (Teacher Resource 9, Student Resource 6 –Safari Times)
  - Students will complete a function table for the following expression
  - Johnny only rode the Jungle King and the Rhino Rides how many of each did he ride? (Jungle King cost 4 tickets and Rhino Rides 2 tickets)

rides on Jungle King (tickets each ride)	rides on Rhino Rides (tickets each ride)	total # of tickets
2	4	12
		50
5	5	30
10		64
12		100

- Differentiation
  - Reteach  
Students will use different color chips to represent each ride or game.  
Students will also use their times tables to help them solve the equation.
  - Enrich  
Students will give a dollar value for each ticket in order to solve for how much money they spent.
- Assessment - Students will create a table to show different number of rides they can go on for the same amount of tickets in their math journals.

### Summative Assessment

- Students will complete an assessment on algebraic equations which will include Exit Ticket (Student Resource 7).
- Students will work in groups of 4 to create a Safari Park game board.
- Review the rules as stated on Teacher Resource 10. (Teacher Resources 3, 10, 11, 12, 13)
- The Spinner must be copied onto card stock.
- Join Teacher Resources 11 and 12 to make a complete game board.
- Students will write the directions.
- Students will explain in detail how the game is played.
- Students will play at least one round of the student created Safari Park game.

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# Safari Operation Game



4

6 = 24

48

2 = 24

28

4 = 24

9

15 = 24

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+

-

×



**Directions:** (1 ride, given # for tickets required)

It's now your turn to have fun in the park. Create a word problem describing the ride you want to get on during the park. Complete the table below that tells you how many tickets are needed for the rides you take. What rule does your table follow?

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Function Table




<u>In</u> Monkeys 	<u>Out</u> Monkeys 
12	36
	72
8	
100	

What is the rule?

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## Brief Constructed Response

### Assessment

The students in Ms. Greene's class are going to visit the Safari Park for a day of fun. Each student wants to ride the rides more than once. They created a function table that shows the number of rides for they can take for given number of tickets required to ride.

### Step A

Complete the function table.

<b>Jungle King</b> 	<b>Rhino Rides</b> 	<b>Monkey Games</b> 	<b>Terrible Tarant</b> 	<b>Total # of Tickets</b>
12				30
8	12	25		65
20	10	11	13	
10	10		24	49
	14	2	30	74

### Step B

Use what you know about function tables to explain why your answer is correct.  
Use words and/or numbers in your explanation.

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# Safari Function



Complete the function table.

<b>Terrible Tarantula</b> <b>6 tickets</b> 	<b>Jungle King</b> <b>4 tickets</b> 	<b>Rhino Rides</b> <b>2 tickets</b> 	<b>Monkey Games</b> <b>1 ticket</b> 	<b>Tiger Treats</b> <b>1 ticket</b> 	<b>Total # of Tickets</b>
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50
$6 \times 5 = 30$					50

# Safari Times

## Safari Times



Johnny rode the Jungle King and the Rhino Rides how many of each did he ride? (Jungle King cost 4 tickets and Rhino Rides 2 tickets)

Times on Jungle King (4 tickets each ride)	Times on Rhino Rides (2 tickets each ride)	Total # of tickets
2	4	12
8		50
5	5	30
10		64
12		100

# Safari Park Board Game

# Exit Ticket

You have just completed a new board game Safari Park. Explain the rules and patterns in your game.

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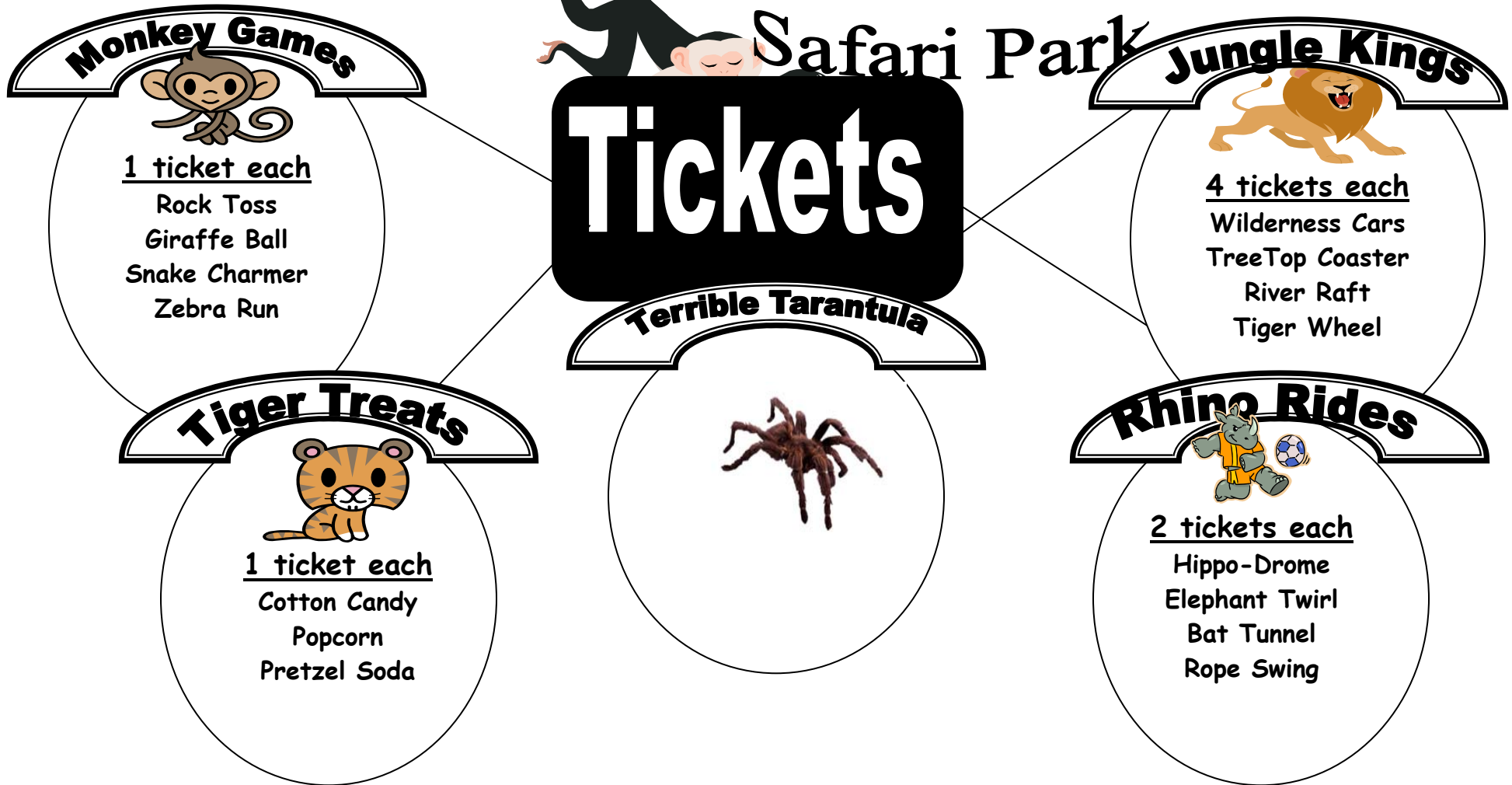
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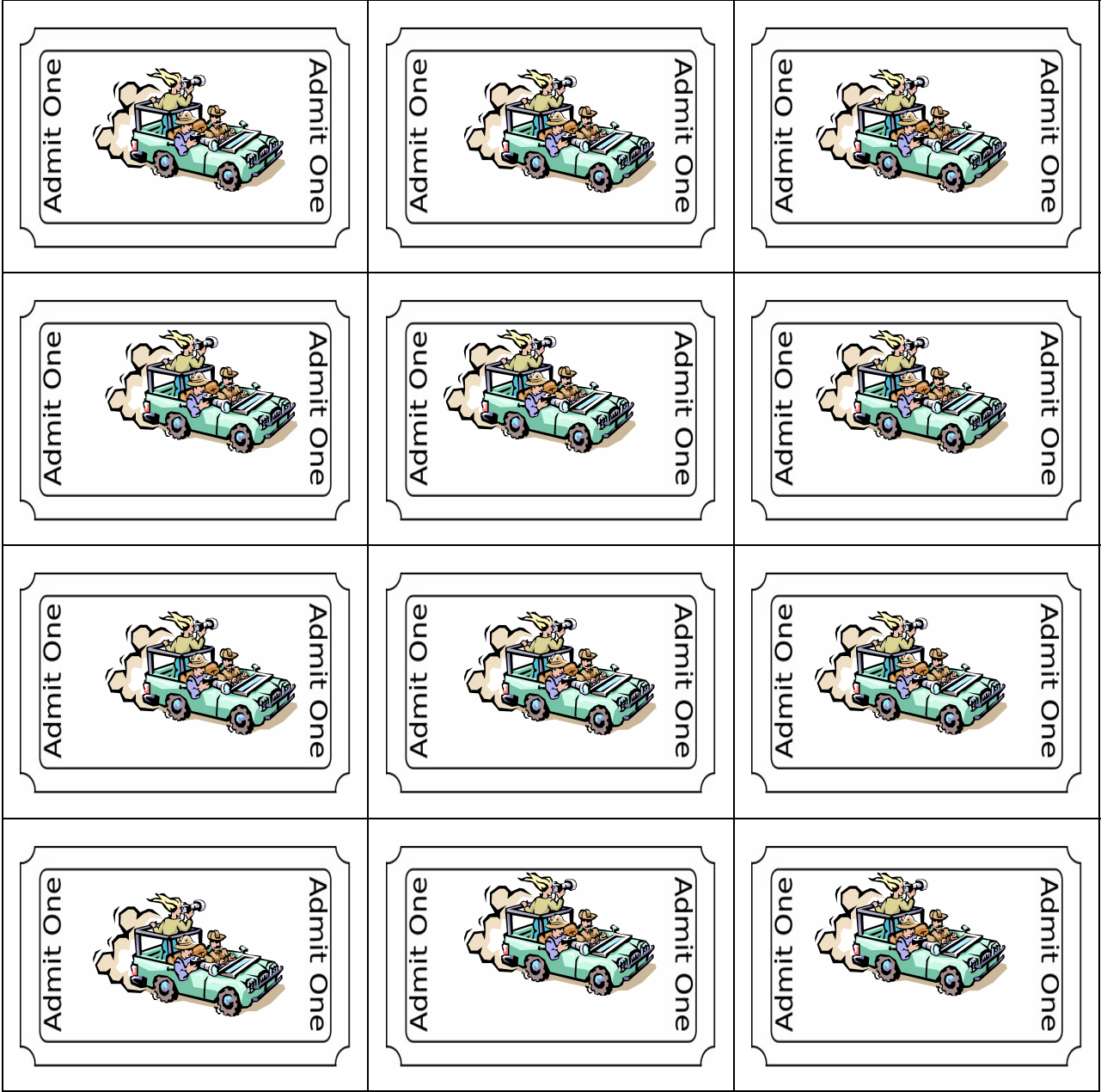


# Exit Ticket













































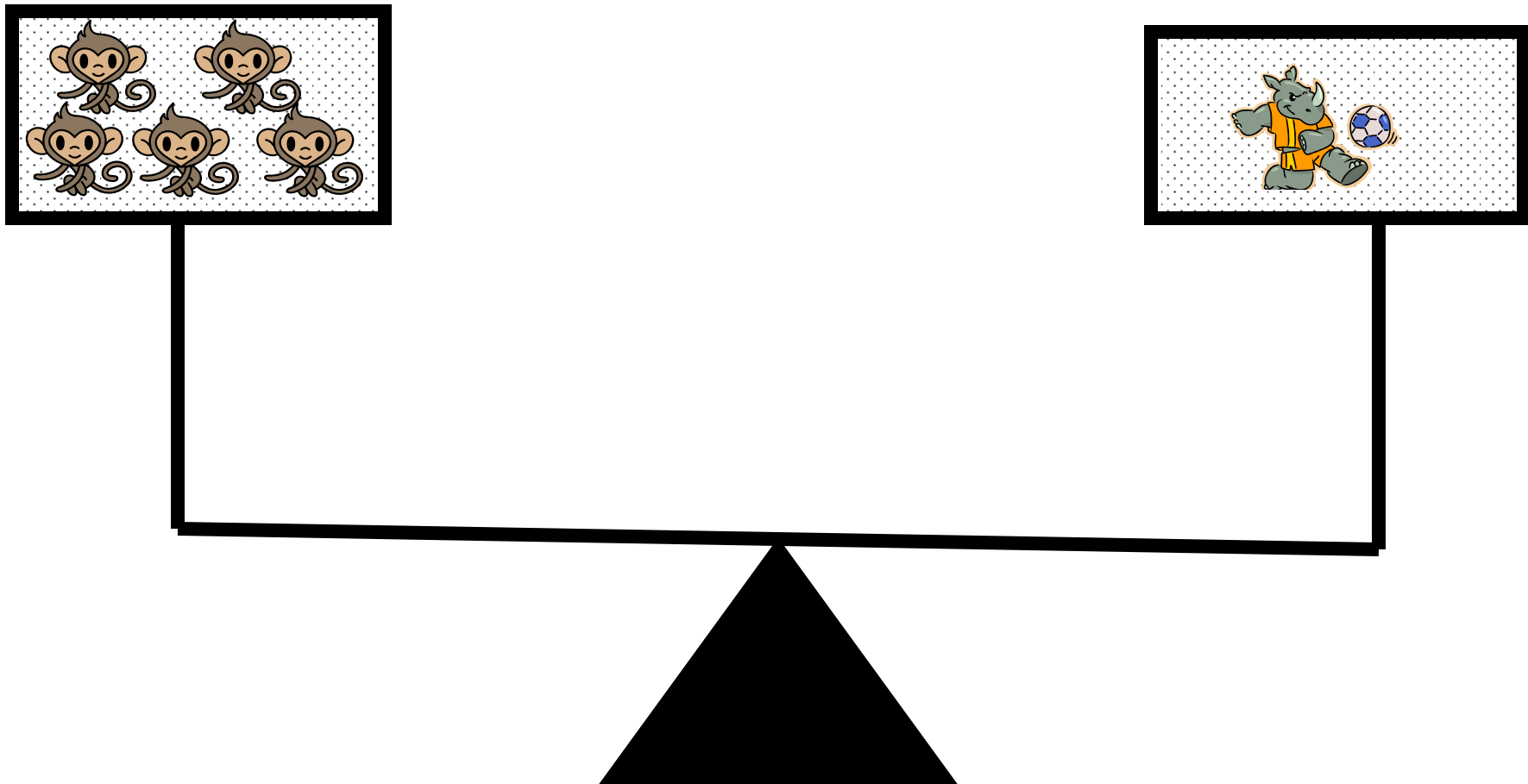
# Ticket Pattern



# Animal Pattern


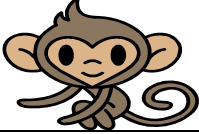
				
				
				
				
				
				
				
				



# Balance the Animals





# In and Out Safari

Answer Key

# of Rhinos 	1	3	12	9
# of monkeys 	5	15	60	45

# of Rhinos 	1	10	5	25
# of monkeys 	10	100	50	250







<u>In</u> Monkeys 	<u>Out</u> Monkeys 
12	36
<b>24</b>	72
8	<b>24</b>
100	<b>300</b>

### Brief Constructed Response

The students in Ms. Greene's class are going to visit the Safari Park for a day of fun. Each student wants to ride the rides more than once. They created a function table that shows the number of rides for they can take and the number of tickets required to ride.

#### Step A

Complete the function table.

Jungle King 	Rhino Rides 	Monkey Games 	Terrible Tarant 	Total # of Tickets
12				30
8	12	25	30	65
20	10	11	13	60
10	10	5	24	49
28	14	2	30	74

#### Step B

Use what you know about function tables to explain why your answer is correct.  
Use words and/or numbers in your explanation.

Add all of the tickets together. Then, subtract the sum from the total to solve for the missing number of tickets.  $12+2+a+12=30$ ,  $8+12+25+b=65$ ,  $20+10+11+13=C$ ,  $10+10+d+24=49$ ,  $e+14+2+30=74$

# Safari Adventure

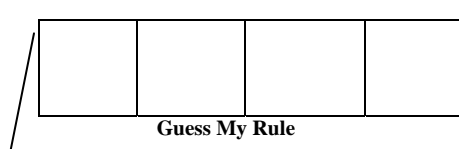


## Guess My Rule!

**Materials:** Construction Paper  
Scissors  
Markers

**Instructions:**

1. Fold construction paper on a "hot dog" (horizontal). Leave  $\frac{1}{2}$  inch at the bottom to write "Guess My Rule".
2. Fold the paper horizontally in half twice. To create 4 equal parts.
3. On the 3 folded lines cut slits to center fold.
4. Use markers to write number pattern, one in each 4 sections under the flaps
5. Students will cover numbers with flaps and reveal them one at a time as peers attempt to guess the rule the student used to make the pattern.



# Safari Times

## Safari Times



### Answer Key

Johnny rode the Jungle King and the Rhino Rides how many of each did he ride? (Jungle King cost 4 tickets and Rhino Rides 2 tickets)

Times on Jungle King (4 tickets each ride)	Times on Rhino Rides (2 tickets each ride)	Total # of tickets
2	4	12
8	2	50
5	5	30
10	12	64
12	26	100





## Safari Park Board Game

**Objective:** Students will create a board game using unknown variables.

**Directions:**

1. Students will work in groups of 4 to create board games using a spinner, game board, a paper clip, and animal patterns. To make the spinner spin students need to place the paper clip in the center of the spinner and use pencil to hold it into place. Students will be able to pluck the spinner in order for it to move.
2. The students will choose one the operation of  $+$ ,  $\times$ , to create a pattern for their game.
4. On the back of each animal pattern students will choose a variable from 0-9 to use with the spinner. (ex:  $+2$ , or  $\times 3$ )
5. Each section of the game board should be labeled the start, finish, and numbered (1-50)
6. Students should include items such as go back spaces, or forward on their game board.
5. Students will create rules for the game with no more than 4 rules.

Game Spinner



